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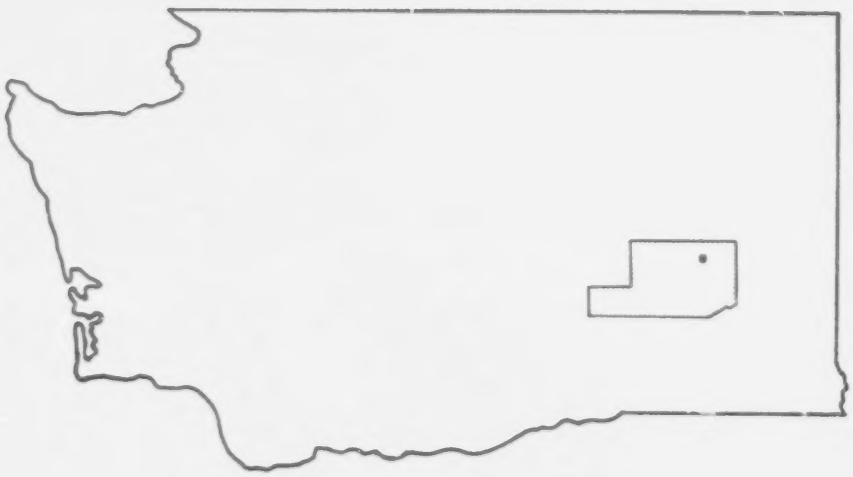
FLOOD INSURANCE STUDY

CITY OF RITZVILLE, WASHINGTON
ADAMS COUNTY



AUGUST 4, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 530005

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
CITY OF RITZVILLE, ADAMS COUNTY, WASHINGTON

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Ritzville, Adams County, Washington and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Walla Walla District, (the study contractor) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-EMW-84E-1506, Project Order No. 1, Amendment No. 1. This work was completed in October 1986.

1.3 Coordination

Streams requiring detailed study were identified at an initial community coordination meeting attended by representatives of the city, FEMA, and the study contractor in February 1984.

On September 23, 1987, the results of the study were reviewed at the final community coordination meeting attended by representatives of the community, FEMA, and the study contractor. The study was acceptable to the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Ritzville, Adams County, Washington. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by overflow at Paha Creek Channel was studied by detailed methods from downstream of the city sewage disposal plant upstream to Bauman Road. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through March 1991.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the City of Ritzville.

2.2 Community Description

The City of Ritzville is located in the north-central portion of Adams County in the southeastern portion of the State of Washington. Ritzville is the county seat and also the largest city in Adams County. Ritzville's economy is based on agricultural activities primarily associated with the service and production of grains from dryland farming. According to U.S. Census Bureau figures, the population of Ritzville decreased from 1,876 in 1970 to 1,800 in 1980 (Reference 1). The counties surrounding Adams County are Lincoln, Grant, Benton, Franklin, Whitman and Spokane. Nearby cities are Marcellus to the north, Ralston to the south and Scrag to the west.

Paha Creek is an intermittent stream that flows southwesterly through the northwestern part of Ritzville and is dry much of the year. However, flows do occur from snowmelt runoff and precipitation, including thunderstorms. Physical features of the Paha Creek drainage basin above Ritzville include rolling hills devoted to dryland wheat farming, expanses of scabrock and sagebrush primarily used for cattle grazing, and lava outcropings that support little vegetation.

The study area has a semi-arid climate with hot summers, cold winters, and frequent winds. In the summer months, temperatures over 90°F are common, with short periods of temperatures exceeding 100°F. During the winter months temperatures regularly drop below freezing and may drop below 0°F for short periods. Observed temperatures at Ritzville range from -24°F to a maximum of 112°F, with a mean annual temperature of 49.1°F (Reference 2).

Early spring, fall, and winter precipitation is usually the result of large frontal systems moving through the Pacific Northwest. However, summer precipitation is usually the result of local

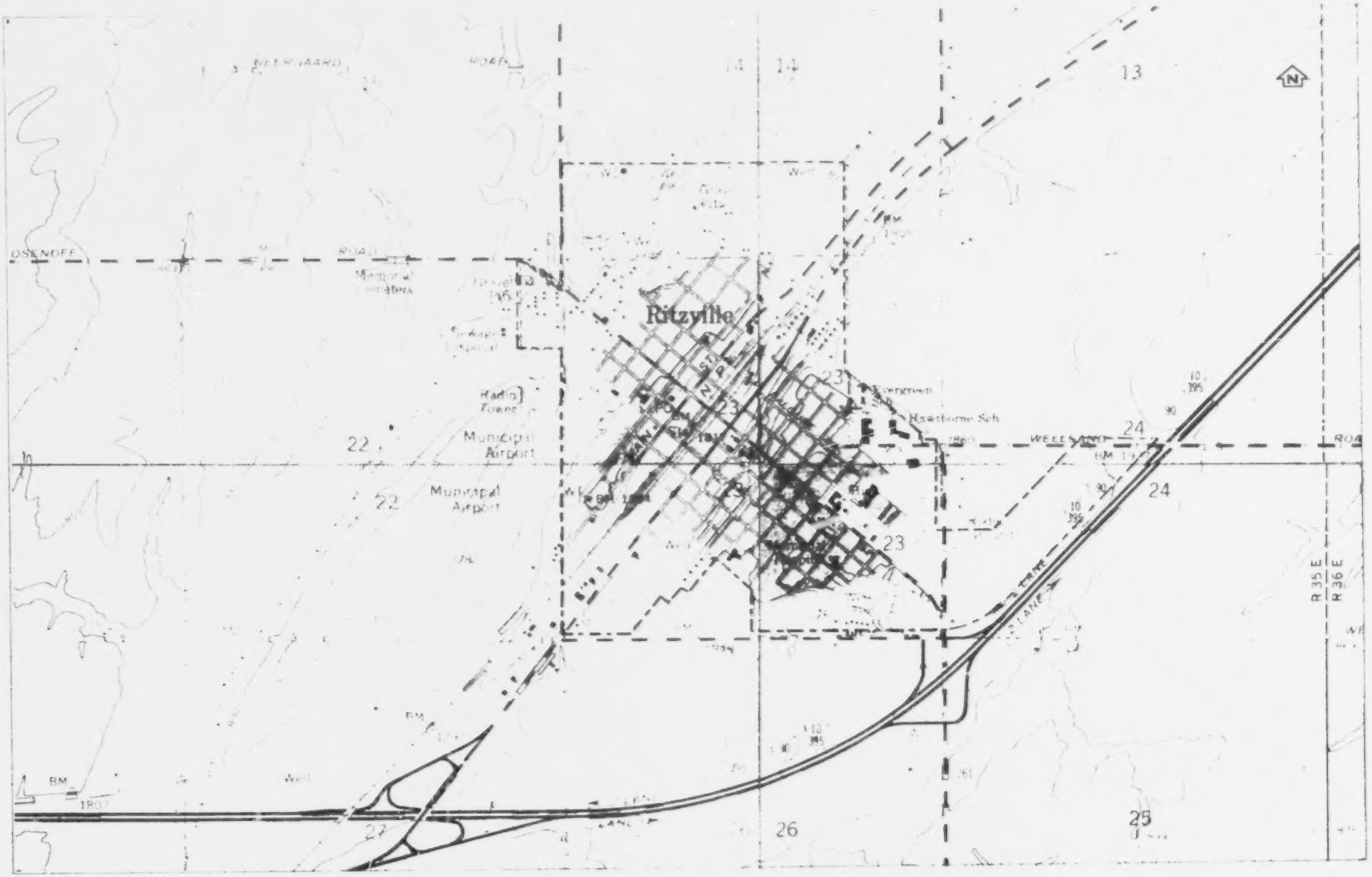

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF RITZVILLE, WA
(ADAMS CO.)

APPROXIMATE SCALE
4 0 4 8 1.2 MILES

VICINITY MAP

thunderstorm activity that can produce high-intensity rainfall for short durations. The mean annual precipitation at Ritzville is 9.4 inches with a record maximum of 16.7 inches. Mean seasonal snowfall at Ritzville is 16.3 inches with a record maximum of 45.6 inches (Reference 2).

2.3 Principal Flood Problems

Flooding in Ritzville from Paha Creek is usually caused by chinook winds (moist, unseasonably warm winds from the southwest) and snowmelt or a combination of rainfall and snowmelt. Three floods from Paha Creek have caused damages to Ritzville in recent years. These occurred on February 23, 1948, January 4 through 6, and 24, 1984. The 1948 flood appears to have been the most severe of the past floods and was the result of chinook winds melting an unusually deep snowpack.

2.4 Flood Protection Measures

Nonstructural measures of flood protection are being used in Ritzville to prevent future damages. These are in the form of land use regulations, adopted from the Code of Federal Regulations, which control building within areas that have a high risk of flooding (Reference 3).

3.0 ENGINEERING METHODS

For the flooding source studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1- and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for the flooding source studied by detailed methods affecting the community.

Because Paha Creek is an ungaged watercourse, a regional frequency analysis was used to determine its frequency statistics. The various U.S. Geological Survey (USGS) stream gaging stations in Washington State listed below were used in a multiple linear regression analysis to relate drainage basin characteristics to discharge-frequency curve statistics.

USGS STATION NUMBER	LOCATION
12433580	Cottonwood Creek at Davenport
12464800	Coal Creek at Mohler
12465000	Crab Creek at Irby
12512500	Providence Coulee at Cunningham
12513000	Esquatzel Coulee at Connell
12465100	Connawai Creek near Govan
12465400	Wilson Creek below Corbett Draw near Almira
12465300	Broadax Draw Tributary near Wilbur
12471100	Paha Coulee Tributary near Ritzville
12471200	Lind Coulee Tributary near Lind
12471270	Farrier Coulee near Scrag
12471300	Weber Coulee Tributary near Ruff
12473700	Kansas No. 2 near Cunningham
12512600	Hatton Coulee Tributary No. 2 near Cunningham
12512700	Hatton Coulee Tributary near Hatton
12513300	Dunnigan Coulee near Connell
13353050	Smith Canyon Tributary near Connell

Basin characteristics used in the analysis were the (1) drainage area, (2) basin mean elevations, (3) normal annual precipitation, (4) basin slope, and (5) basin length. Using regression equations, these characteristics were related to the discharge-frequency statistics--mean logarithm and standard deviation. Once the regression equations were developed, the Paha Creek basin characteristics were computed and entered into the equations, yielding the mean logarithm and standard deviation for Paha Creek. The resulting frequency statistics and a skew of -0.20 from Plate 1 of Bulletin 17B (Reference 4) were used to compute an annual peak-discharge frequency curve for the ungaged study site, Paha Creek at Ritzville, Washington.

Peak discharge-drainage area relationships for Paha Creek are shown in Table 1.

TABLE 1. SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Year	50-Year	100-Year	500-Year
Paha Creek At Division Street Bridge	23.8	925	2,500	3,500	6,800

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

Cross sections for the backwater analysis of the stream in the study area were obtained from aerial photographs and field surveys (Reference 5). The below-water sections were obtained by field measurement. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry. The footbridge at the Wheatland Community Fairgrounds was not included in the backwater analysis because a field inspection indicated that the bridge is structurally unstable and could not withstand floodflows of the specified magnitudes.

Roughness values (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and floodplain areas. The roughness value for the main channel of Paha Creek is 0.037 with floodplain roughness values ranging from 0.045 to 0.055 for all floods. The acceptability of all assumed hydraulic factors, cross sections, and hydraulic structure data was checked by computations that duplicated historic floodwater profiles.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the COE HEC-2 step-backwater computer program (Reference 6). Flood profiles (Exhibit 1) were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Paha Creek were calculated using the slope-area method discussed in the HEC-2 Users Manual (Reference 7).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the stream studied by detailed methods, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400, with a contour interval of 5 feet (Reference 5).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE); and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2.)

Approximate 100-year floodplain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map for the City of Ritzville (Reference 8).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a

tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100- year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodway in this study is presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodway presented in this study was computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated at selected cross sections (Table 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

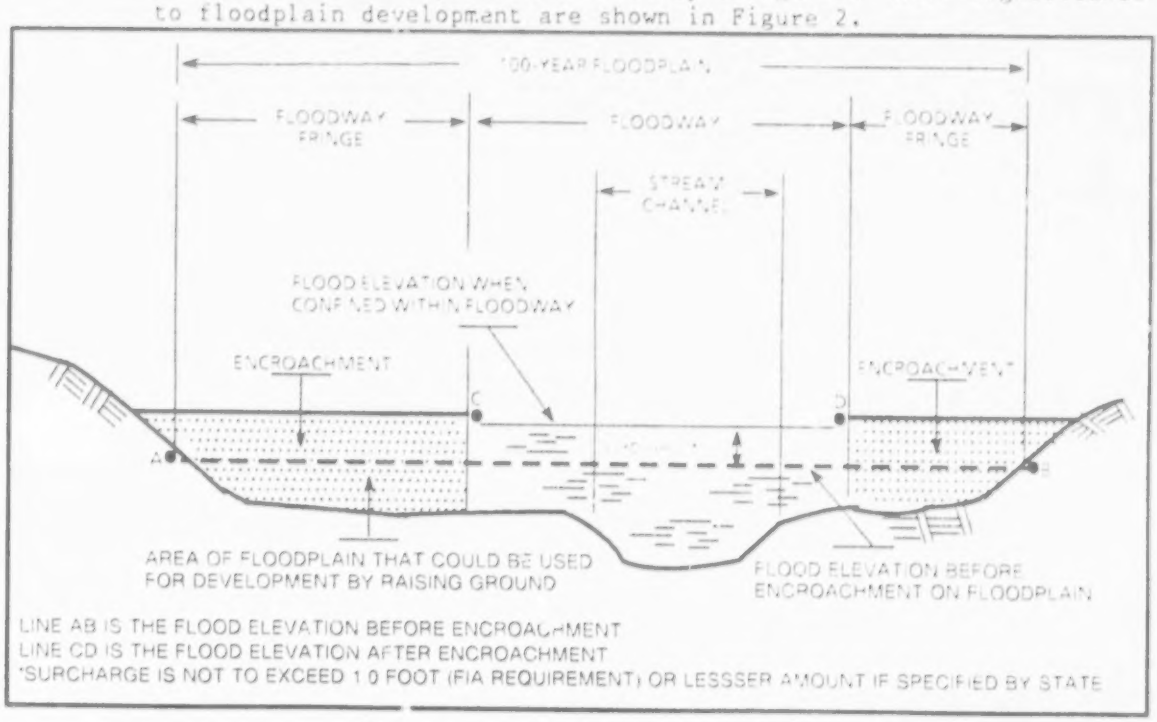
100-YEAR FLOODPLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
A
B
AREA OF FLOODPLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOODPLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSSER AMOUNT IF SPECIFIED BY STATE

Figure 2. Floodway Schematic

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Paha Creek								
A	-1295	272/55[2]	539	6.5	1787.5	1787.5	1788.5	1.0
B	-424	226	992	3.5	1792.2	1792.2	1793.2	1.0
C	-50	313	1231	2.8	1792.9	1792.9	1793.9	1.0
D	260	232	1334	2.6	1795.6	1795.6	1796.1	0.5
E	973	372	1691	2.1	1795.7	1795.7	1796.5	0.8
F	1527	521	2108	1.7	1795.8	1795.8	1796.8	1.0
G	2205	441	1128	3.1	1797.3	1797.3	1798.2	0.9
H	3054	391	1053	3.3	1799.7	1799.7	1800.7	1.0
I	3786	400	1182	3.0	1801.4	1801.4	1802.4	1.0

[1]Feet Along Channel Centerline From Center of Division Street Bridge
[2]Width/Width Within Corporate Limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF RITZVILLE, WA
(ADAMS CO.)

FLOODWAY DATA

PAHA CREEK

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of tne engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

A Flood Hazard Boundary Map was prepared for the City of Ritzville in January 1976 (Reference 8). Because of the more detailed study procedures used, this Flood Insurance Study supersedes it.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Federal Regional Center, 130 228th Street, S.W., Bothell, Washington 98021-9796.

9.0 BIBLIOGRAPHY AND REFERENCES

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2. Pacific Northwest River Basins Commission, Meteorology Committee, Climatological Handbook, Columbia Basin States, Precipitation, Vol. 2, September 1969.

3. U.S. Department of Housing and Urban Development, Federal Insurance Administration, "Code of Federal Regulations, Title 24, Chapter 10, Parts 1910.3A and 3B," Federal Register, Vol. 41, No. 207, Revised 1976.

4. U.S. Water Resources Council, Bulletin 17B, "Guidelines for Determining Flood Flow Frequency," September 1981.

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8. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Ritzville, January 1976.

Chow, Ven Te, Open Channel Hydraulics, New Yorks McGraw-Hill Book Company, 1959.

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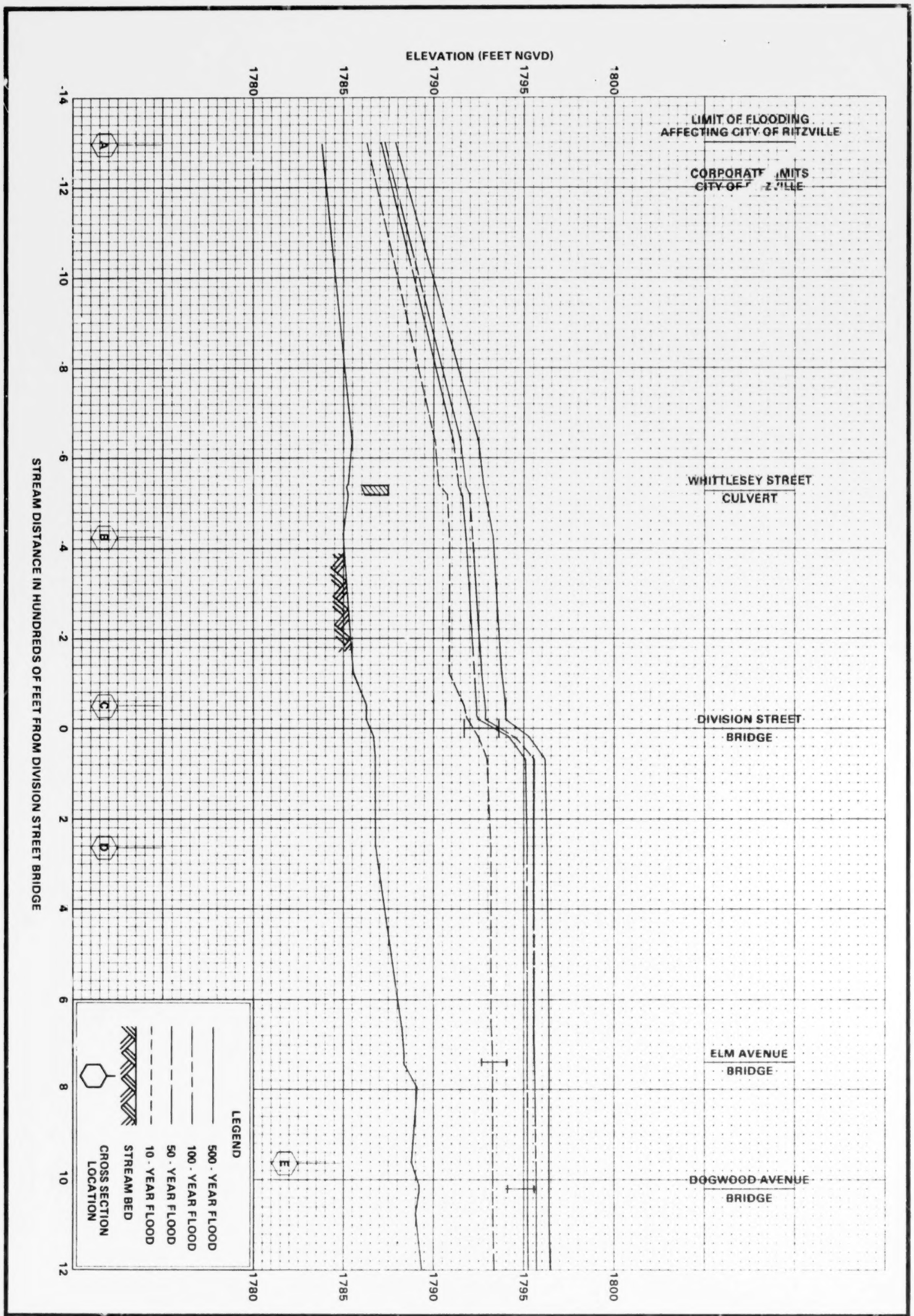
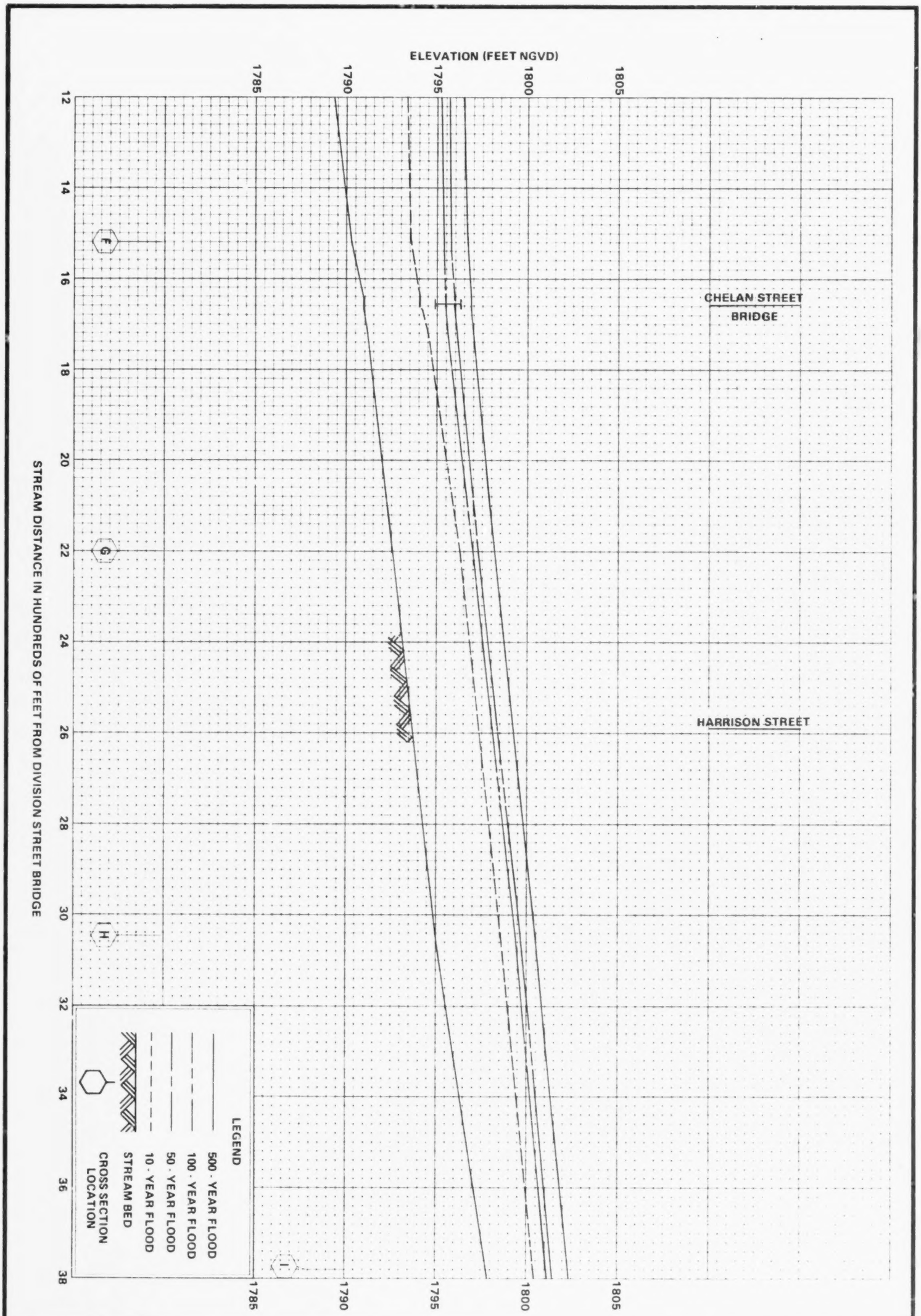
EXHIBIT 3 - ELEVATION REFERENCE MARKS
CITY OF RITZVILLE, ADAMS COUNTY, WASHINGTON

Reference Mark	Elevation (feet NGVD)	Description of Location
RM 1	1817.03	A standard USGS disk stamped "1812.18T" set in the top of the northeast end of the bottom step at the southeast or main entrance to the Adams County Courthouse, 7.7 feet northeast of the center of the entrance, 5.8 feet southeast of the southeast wall of the building, 0.6 foot above the walk.
RM 2	1795.19	Brass screw and washer stamped "ACR-84-3" set in center of Division Street, approximately 50 feet northwest of Fir Avenue intersection.
RM 3	1816.60	5/8 inch rebar set with aluminum cap stamped "ACR-84-5" located approximately 700 feet northwest of the intersection of Birch Avenue and Cascade Street.
RM 4*	1812.78	Brass screw and washer stamped "ACR-84-8" set in center of Bauman Road 1,100 feet north of the intersection of Danekas Road.

*Outside Corporate Limit



01P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF RITZVILLE, WA (ADAMS CO.)	FLOOD PROFILES PAHA CREEK



02P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF RITZVILLE, WA
(ADAMS CO.)

FLOOD PROFILES

PAHA CREEK

FLOOD PROFILES

PAHA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF RITZVILLE, WA
(ADAMS CO.)

03P